

**Comments and Responses on SOCCR/SAP 2.2 Draft 1 (May 2006)
CHAPTER 3**

COMMENT FROM PEER REVIEWERS						AUTHOR'S RESPONSE						
Comment Number	Reviewer ID	Chapter	Page	Line	Comment Text	Acknowledged, but no further response or revisions are required	Revisions have been incorporated as suggested in the comment	Agree, but see "Notes on Response"	Agree, but elaboration is precluded by length limitations	Disagree; see "Notes on Response"	Beyond scope of report/chapter	Notes on Response
03-001	3	3	3-1	25-27	In general there was a lack of consistency in numbers of significant figures between the absolute numbers (3-4 significant digits) and the percentages (generally 1-2 significant digit). This is potentially misleading in terms of uncertainties and some more thought on presentation is required here.			X				Because this report is also for policy makers and other non-scientists it is important not to introduce a convention that is used only in the sciences. We have retained 1MTC and 1% as the smallest units whenever possible. But we have also faithfully retained whatever convention was used in the original published literature as Tony and Greg recommended. Scientists are capable of the mental math necessary to convert the uncertainties that we report into significant digits. On the other hand, there were a few places where statistics like carbon intensity or per capita emissions were reported in the previous draft. We have now taken care to report these to the appropriate number of significant digits.
03-002	3	3	3-1	30-37	The bullets on these lines of text largely repeat material given in the KEY FINDINGS in Chapter 2. Thus, the authors of the two chapters should coordinate their presentations to avoid unnecessary duplication.		X					We have coordinated a partitioning of the material with Chris Field and have removed all text from Chapter 3 that evaluates North America in the global context. We have also removed one figure for the same reason. Chapter 3 is about North America. Chapter 2 is about the globe.
03-003	3	3	3-2	1-3	Same comment as #03-002		X					Same reply.
03-004	3	3	3-3	19-30	I liked the way the data and uncertainties were presented in Table 3-1. However, I think the table is too complex for a general audience without an extensive amount of additional explanation. Incorporate into a text box to deal with this or expand the discussion in the first paragraph of the subsection? Which year(s) does this set of values represent?			X				The Table has been split in two so that Table 3-1 deals only with sources and sinks. The new Table 3-2 gives the horizontal transfers. Both Tables give citations that contain the time intervals covered by the estimates. Most were from publications of the last five years although some are older, and most correspond to the period of the 90's. This is now spelled out on page 3-5.
03-005	3	3	3-17	Table 3-1	Same comment as #03-004			X				Same reply.
03-006	3	3	3-3	19-22 and 24-28	See comment # 03-001. Also note that Chapter 15 indicates that the estimate of river export to the oceans (given as ~35 Gt C in Table 3-1) is essentially unknown.			X				Same reply as to 03-001 but see also in Table 3-2 that the uncertainty is listed at 100%
03-007	3	3	3-3	27	The word "are" should be replaced by "may be;" the uncertainties are huge, per Chapter 15.		X					Made the change
03-008	3	3	3-3	32	The land sink is given as 1.1 Gt C per year (or 1100 Mt C per year) on page 2-7 vs the figure of 1500 Mt C per year given here. What is the reason for the difference and which value is preferred?		X					This material has been removed as it is covered in Chapter 2.
03-009	3	3	3-4	3	Table 3-1 is referenced as the source of information given on lines 1-3 but it contains no data on land area or global carbon sinks.		X					Thanks, removed reference to the table.
03-010	3	3	3-4	19-25	Excellent! This is the sort of information I was asking for in previous comments, such as: What types of activities are most critical to achieving the goals of carbon cycle research? However, it would also be useful to estimate long we think it will take to obtain such estimates and to identify critical obstacles (e.g., technology development needed to provide meaningful data)?				X			The answer depends on what is being inventoried and so would require a short paragraph. We lack the space.
03-011	3	3	3-4	24	If I have read Table 3-1 correctly there are five, rather than four, missing pieces to the puzzle represented by Canada's carbon budget.		X					Thanks. Change made.

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03-012	3	3	3-5	25-30	The second sentence in the caption for Fig. 3-2 reads as follows: Note that carbon emissions per unit GDP decelerate as a country gains wealth. I could not discern such a pattern because most countries of the world are not identified in the figure and the patterns for countries in the region identified as Western Europe are different from those for the U.S, Japan, and Canada (the patterns for which are similar to that for China).		X					This figure and all associated text have been deleted. The subject belongs in Chapter 2.
03-013	3	3	3-6	9-10	Because of the general readership intended for the report, I suggest saying explicitly why C emissions from coal, oil, and natural gas are different, e.g., because of increased H:C ratio as you move from coal to gas.					X		The general reader does not need to know this to understand what is being said in the paragraph. The added material would break the flow of the idea that is being developed.
03-014	3	3	3-6	31-34 et seq	The organization of the figure caption is confusing and the sets of information shown in the three panels of the figure are different enough to deserve being separated into three separate figures.		X					We have separated them into three figures.
03-015	3	3	3-7	12-22	I think that most of this material should have been used on page 3-3 to introduce the subsection on Carbon Sinks. It seems out of place here, well after the critical discussion of Table 3-1 to which it is related.		X					The paper has been completely reorganized. There is now one fossil fuel section and one carbon sinks section (rather than two of each).
03-016	3	3	3-8	10-11	The material highlighted in bold belongs in the introduction to the subsection on Carbon Sinks on page 3-3, where Table 3-1 is called out.		X					See reply to 03-015.
03-017	3	3	3-8	19-21 and 30-33	What are the errors in the cited estimates? Are the number of significant figures given justified, given the errors? The value of 23 Mt C yr ⁻¹ for urban and suburban trees given in line 19 and referenced to Chapter 14 contrasts with the range of 13.7-25.9 Mt C yr ⁻¹ given in Chapter 14. How was the point estimate derived from this range?		X					We added uncertainties to these numbers in the text because they are known and because the table only supplies the uncertainty of the aggregated estimates for forests. We also point out that 19 is the mid-point in the range from Chapter 14.
03-018	3	3	3-8	27-28	One published study of one site, however well performed, probably doesn't constitute confirmation. How about inserting the words "are producing data that seem to" just before the word "confirm" in line 27.		X					Changed as requested.
03-019	3	3	3-9	1	The text refers to "The two studies of Mexican forests." Do I correctly interpret this to mean that these are the <i>only two</i> studies of Mexican forests that deal with the subject at hand?			X				Yes, the only two published carbon inventories for Mexican forests that we know of. This is now highlighted in the text.
03-020	3	3	3-9	27-29	Excellent! Any thoughts to on how to tackle this challenge successfully?			X				Show me the money.
03-021	3	3	3-10	3	The current wording is awkward. How about deleting "1.5 to-6 Mt C yr ⁻¹ⁿ " and inserting the words "either a small source of 1.5 Mt C yr ⁻¹ or a sink of 6 Mt C yr ⁻¹ⁿ after the word "and"?"		X					Done.
03-022	3	3	3-10	7-8	Wording seems awkward. How about deleting replacing the last part of the sentence on line 8 and inserting with "because plant productivity has exceeded decomposition" before the word "thousands" on page 7?		X					Done.
03-023	3	3	3-10	16-18	Good, but, given the technical challenges associated with doing this, should recommendations on how to do this also be given?				X			No space to discuss this in a summary chapter.

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03-024	3	3	3-10	19-27	The potential importance of CH ₄ with respect to its properties as a GHG begs the question why distinctions haven't been made about differences in fluxes of the various types of carbon compounds. Are there other situations where fluxes of CH ₄ or CO need to be considered specifically. Perhaps a brief discussion somewhere in the report (at the beginning of Chapter 3?) could suffice to answer this question, e.g., to estimate in rough terms what uncertainties are introduced into source/sink estimates by considering carbon fluxes without regard to the chemical species present. I suspect that these would be quite small in all but a few (but potentially very important cases, e.g., marine sediments, permafrost soils, and wetlands). Finally, shouldn't the reference in line 25 be to Chapter 13 rather than Chapter 9?				X			We all agreed to focus on CO ₂ and short-change methane in this first SOCCR report and we knew we would be criticized for it. There is no space to do justice to methane, but there will be in the next report because we will be able to shorten the discussion of CO ₂ by referencing the first report. We are just going to have to take our lumps about methane. We did fix the Chapter reference however.
03-025	3	3	3-10	30	Probably need to define alluvium and colluvium for a more general audience.		X					Done.
03-026	3	3	3-11	1, 5, 8, and 29-33	Once again: What are the errors in the cited estimates? Are the number of significant figures given justified, given the errors?		X					In addition to splitting former Table 3-1 into two, we also added uncertainties to each number in the table rather than, as in the previous version, including only a summary uncertainty for the entire row. The new Tables 3-1, 3-2 and 3-3 now contain all of the uncertainties that are being asked for. See also the response to 03-001 about significant digits.
03-027	3	3	3-11	19-26	Within the coastal waters of North America (see Fig. 15-3) are significant deposits of methane hydrates, which at least some analyses identify as a potentially significant carbon source to the atmosphere under some climate-change scenarios, one which could augment global warming from CO ₂ . Given results from paleoclimate studies that indicate that such a release led to dramatic warming during the Tertiary period, doesn't the uncertainty in the future carbon flux associated with this potential source deserve to be mentioned somewhere in the report, e.g., in Chapters 3, 12, and/or 15?				X			See the response to 03-024.
03-028	3	3	3-17	Table 3-1	How can the totals for the U.S, Canada, Mexico, and North America all have the same estimated uncertainty, given the wide variation in inputs (including more missing data for Canada and Mexico than for the U.S.)? The estimated uncertainty of 10% for emissions from coastal waters of North America is in seeming conflict with the material in Chapter 15, which suggests that the errors are huge and exceed ±100% (see page 15-1).		X					See the response to 03-026. Table3-1 and 3-2 now contain separate uncertainties for each country. Also, the uncertainty for coastal waters in the previous version was an error and we corrected it.
03-029	3	3	3-18	Table 3-2	What are the estimated uncertainties in the tabulated values?		X					The Table (now 3-3) now includes them.
03-030	3	3	3-23	16-19	Figure 3-2 does not provide the information on emissions and change in cropland area discussed in this sentence.		X					We removed the reference to the Figure.
03-031	3	3	3-24	31-33	Again: What are the errors in the cited estimates? Are the number of significant figures given justified, given the errors?		X					The original articles included no uncertainties for land areas. We simply report their published estimates. However, Table 3-1 now includes the uncertainty for the forest carbon flux from the Masera et al. article. See the response to 03-001 about significant digits.

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03-032	5	3	3-2	22	The other chapters don't seem to have such an extended introduction. This should be homogenized. The main points of this introductory summary are also mentioned in the section "key findings".		X					The paper has been completely reorganized. There is now one fossil fuel section and one carbon sinks section (rather than two of each).
03-033	5	3	3-3	15	Zero emission growth doesn't mean zero emissions. Since the target is essentially a decrease in emissions, the reduction to 0% growth shouldn't be overemphasized.		X					Point taken. We changed the sentence so that it uses a 1% annual decline in emissions as a target.
03-034	5	3	3-3	25	"i.e." should be replaced by "e.g."		X					OK, ergo concordantly.
03-035	5	3	3-4	4	The introductory summary shouldn't refer to the appendix. First there should be more detailed information contained in the chapter itself that can refer to the appendix.		X					Obviated by the reorganization mentioned in the response to 03-015 and 03-033.
03-036	5	3	3-5	20	The sentence "Thus, countries with a slope close to the line have higher carbon intensities than countries far from the line." should be moved to line 17, before the sentence starting "Note that the United States is no outlier in this respect."		X					Obviated because the Figure and associated text are no longer in the paper.
03-037	5	3	3-7	10-12	I would recommend first mentioning the focus of this chapter, then referring for historical development to the appendix 3A. Otherwise the reader may be inclined to read first the appendix.		X					Obviated by the reorganization mentioned in the response to 03-015 and 03-033.
03-038	5	3	3-7	12 and 26	Regarding the phrases "we rely exclusively on inventory methods", and "We do not include estimates obtained in this way because they are still highly uncertain at continental scales": I don't think it is a wise decision to not at all include results from inverse modelling of atmospheric observations. The reasons are given in the following four items.					X		It is not fair to say that we have not included the results from inverse modeling studies. We have reviewed them and correctly stated that they provide answers consistent with inventories but with much wider uncertainties. This is a fact.
03-039	5	3	3-7	12 and 26	Atmospheric inversions provide independent evidence, even if current uncertainty estimates seem larger than inventory based approaches.			X				We emphasize this now in an added sentence at the end of the paragraph.
03-040	5	3	3-7	12 and 26	Estimates from inventory methods need upscaling from the plot scale to the region/continent; atmospheric inversions provide a constraint at these scales that are inaccessible to other methods.					X		Again, we emphasize that inverse methods provide an important independent check on inventories as stated in the response to 02-039, but the fact remains that inverse methods are less accurate. The average reader cares about the level of uncertainty, not upscaling (necessary with inventories) or down-scaling (necessary with inversions).
03-041	5	3	3-7	12 and 26	Interannual variability in biosphere-atmosphere exchange cannot be measured with inventories that are repeated every 5 to 10 years; the atmosphere provides information on this variability, which can give insight in biosphere-climate interactions (c.f. Roedenbeck et al., Atmos. Chem. Phys., 3, 1919–1964, 2003).			X				We have added a sentence about this at the end of the paragraph.
03-042	5	3	3-7	12 and 26	Comparing uncertainty estimates of a single inventory based assessment with the overall uncertainty of multiple inversion results (several transport models, coarse and fine temporal and spatial resolution) might be misleading; a comparison of many inventory based assessments with a single inversion result would be required for a more balanced assessment of uncertainties.			X				Agree, but this Chapter, like the Pacala et al. paper, synthesizes the results of many inventories and uses the variation among estimates as well as the uncertainty reported for each estimate to set overall uncertainties. Thus, we actually compare many inventories with many inversions.

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03-043	5	3	3-7	12 and 26	Further it should be mentioned that current developments in the CO ₂ measurement network (e.g. tall observing towers, remote sensing of atmospheric CO ₂ columns from space) as well as in inverse modelling (increased spatial and temporal resolution, coupling of atmospheric transport with better a priori information in form of flux models) will provide a significantly higher data density for future assessments.			X				Agree. We have added a sentence about this at the end of the paragraph.
03-044	5	3	3-17	3-8	A relative uncertainty of numbers that can be either positive or negative does not make sense. For example, agricultural soils in Canada and Mexico would have a 95% confidence range from 0 to 0 Mt (i.e. zero uncertainty), which is obviously wrong.			X				Although the concept of a relative uncertainty does not depend on sign (plus or minus a positive or negative number yields the same range), estimates of zero need special handling. We have now included footnotes to report the uncertainties of the two entries of zero in Table 3-1.
03-045	6	3	General		One of my major criticisms of the report is that in the Executive Summary as well as in Chapter 3 (except for Table 3-1 and page 3-7, line 19-22) no uncertainty ranges of the sources and sinks fluxes of carbon in North America are given. For example, the estimated uncertainty of fossil fuel CO ₂ emissions is about 10% (with 95% confidence, see Table 3-1) but up to four significant digits of the cited numbers are given. This deficiency is even more obvious when it comes to the sinks which in most cases are uncertain to within 50-100%. This is very misleading as it gives the impression to the reader that the fluxes reported would be known to very high precision, but in fact the contrary is the case. The digits in the reported numbers need to be reduced to the significant ones (i.e. ≤ 2) and errors need to be reported.			X				Please see the Responses to 03-01, 06, 17, 26, 28, 29, 31, 44.
03-046	6	3	General		To calculate the mean increase rate of fossil fuel CO ₂ emissions, the authors chose the time period of 1974 – 2003 (30 years). This period includes 12-15 years of constant or even decreasing emissions while the last 20 years, starting about 1983 until today show a much larger increase rate than 1% per year (Figure 3-1). Later, e.g. in Figure 3-2 when discussing the relation between GDP and fossil fuel CO ₂ emissions the time window from 1980-2003 is used. I think it would be more appropriate to choose the same time periods for the analysis of the emissions increase rate throughout the report.					X		We removed Figure 3-2 and so the only time interval examined is 1974-2003. However, we also repeated the analysis for the period in former Figure 3-2 (1980-2003) and got the same answer (emissions growth is actually a little smaller at 0.8% per year). The 23-year period is artificial and was used in Fig. 3-2 because the data for every country is only available on the EIA website for this period. We think that a thirty-year period has pedagogical advantages, and all of our qualitative conclusions do not change if we use 30 as opposed to 23 years. So we have decided to stick with the 30-year average.
03-047	6	3	3-2 and 3-4	27 and 1	The authors refer to the global land area and the North American share of 16.5 % of this area. I think a relation of the North American carbon sink to the total global land area is not really appropriate here as total land area includes Antarctica and Greenland (ca. 10%), as well as deserts (ca. 6%). A comparison with land areas with similar ecosystems may be appropriate but I would suggest skipping this relation completely.		X					We removed this material because it belongs in Chapter 2.

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03-048	6	3	General		There is a lot of repetition in the Executive Summary between the sections "How do North American carbon sources and sinks relate to the global carbon cycle" and the following section which is dealing only with North American carbon sources and sinks. The Executive Summary could be well shortened if the "relation to the global carbon cycle" would be imbedded in the latter section.		X					We have coordinated a partitioning of the material with Chris Field and have removed all text from Chapter 3 that evaluates North America in the global context. We have also removed one figure for the same reason. Chapter 3 is about North America. Chapter 2 is about the globe. The Executive Summary is outside of our jurisdiction.
03-049	6	3	General		In Chapter 3 there are even more repetitions of this kind as there is a section on "Key Findings" which is nice but this is followed by an "Introductory Summary" which e.g. for the fossil fuels has approximately the same length as the main section on "North American fossil fuel emissions". Again I would combine the "Introductory Summary" with the main sections which would avoid these many repetitions. In fact, most of the message of the section is summarized in Table 3-1 so that Chapter 3 could be shortened considerably without losing the major messages.		X					The paper has been completely reorganized along the line suggested. There is now one fossil fuel section and one carbon sinks section (rather than two of each). It is now considerable shorter.
03-050	6	3	3-19	Fig 3-1	Figure 3-1 has a somewhat odd scaling, would be easier to read if a metric system for the ticks was used.		X					We edited the Figure.
03-051	6	3	3-21	Fig 3-3	Figure 3-3 should have larger labels and in (a) the green dots do not copy well in b&w. The sectors in the caption in (c) should be named the same as in the legend.			X				The Figure should be edited if it will not be included in color. Label sizes depend on the size of the Figure in the printed version. We changed the legend as recommended.
03-052	6	3	General		It would be very helpful and much more instructive if SI units were used for the fluxes throughout the text, i.e. instead of Mt C yr ⁻¹ it should read 10 ¹² gC. My favourite would be 10 ¹⁵ gC = 1 Pg C everywhere which would also solve the problem with the large numbers with insignificant digits as those numbers will become small then.					X		Again, this report is not just for scientists. MtC is opaque enough to the lay reader. 1PgC is worse. Moreover, while Gt or Pg may be natural at the global scale (because this unit yields integers at the resolution of significant figures), Mt or Tg are more natural at the level of an individual country or component of an inventory. Most of the literature estimates for single countries are in Mt. We are sticking with the decision to report numbers to within 1 Mt and 1%.
03-053	6	3	3-1	30	Should read North American "fossil fuel" carbon dioxide emissions ...		X					Done.
03-054	6	3	3-2	31	EIA needs to be explained		X					Done.
03-055	6	3	3-2	33	"with approximately ... global total" should be deleted as it was mentioned in the sentence before.		X					Done.
03-056	6	3	3-2	36	It should read: Total U.S. emissions "are expected" to continue growing ...			X				The rewriting necessary to deal with 03-046 obviates this comment.
03-057	6	3	3-3	28	However, "much of the CO ₂ ..." "much" could be something between 40% and 95%, is there an approximate number to be given, such as more than 50% or so ?			X				We rewrote this as follows: However, the portion of the coastal carbon flux caused by human activity is thought to be close to zero and so...
03-058	6	3	3-5	20	Should read ...to the "solid" line ...		X					Obviated because figure removed.
03-059	6	3	3-7	31	(1700 MtC yr ⁻¹) here I would also put a minus sign as this number should be compared with the -753 Mt C yr ⁻¹ . The signs of the numbers of sources and sinks should be VERY consistent throughout the text !! I am not sure if this is the case yet.		X					Obviated by the deletion of material that belongs in Chapter 2.
03-060	6	3	3-8	7	Should read ...and North America "as a whole" are listed ...		X					Done
03-061	6	3	3-8	8-10	Mixing up "millions" and "billions" could immediately be avoided if numbers were always given in Pg C or Pg C yr ⁻¹ .					X		Agreed, but see 03-001 and 03-052. I think that lay people have an easier time switching from millions to billions than they would have dealing with Pg. Obviously if the editors feel otherwise, then we can change to whatever units they want.

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03-062	6	3	3-8	10-11	I do not understand why reference is given here to Table 3-1.		X					Moved the sentence and split the preceding one in two to fix this.
03-063	6	3	3-8	27-28	To "confirm" estimates of inventories and to "converge towards better agreement" (see 3-25, line 18) are of significantly different quality ... A more quantitative statement should be made here.			X				See response to 03-018. We also rewrote the sentence in 3-25 line 18, to improve clarity.
03-064	6	3	3-9	4	That these 10 years old numbers are used in Table 3-1 should be explicitly mentioned.		X					We added a sentence here to highlight this fact.
03-065	6	3	3-10	13	The unit Gt C should be avoided here, better use Pg C (or 1000 Mt C).				X			See the response to 03-052.
03-066	6	3	3-10	19-20	Are the CH ₄ fluxes included at all in the carbon fluxes reported here (i.e. cattle breeding and rice cultivation as anthropogenic sources). This should be made clear.			X				We rewrote the sentence to make this clear.
03-067	6	3	3-10	30-32	What kind of reservoirs ?			X				Rewritten as "sedimentation in artificial lakes".
03-068	6	3	3-18	Table 3-2	What are the uncertainties of the carbon stock numbers given here ?		X					Again, we added these to the Table. See 03-029.
03-069	6	3	3-23	19	I do not see any cropland change plotted in Figure 3-2.		X					Again, we omitted the reference to the Figure. See 03-030.
03-070	6	3	3-25	14	... consistent within several tens of g C m ² yr ⁻¹ for ... Here it would be better to report relative rather than absolute deviations.		X					We added a parenthetical remark that spells out the equivalent relative deviation.
SH-003	SG	3	3-5	1	I think it worthwhile pointing out that the comments regarding the likelihood of increasing C sink associated with lengthened growing season have recently been clarified in work indicating that a substantial portion of N.American forests are actually in decline under a warming climate (probably an acclimation effect) whereas tundra areas are increasing in productivity, [REF: Goetz, S. J., A. Bunn, G. Fiske, and R. A. Houghton. 2005. Satellite observed photosynthetic trends across boreal North America associated with climate and fire disturbance. Proceedings National Academy of Science 102:13521-13525.] This assessment, using 22 years of satellite imagery, accounted for the influence of fire disturbance. I think we have to be cautious about this assumption of increasing productivity, particularly when the observations suggest otherwise, before changes in vegetation composition catch up with the new climate regime.		X					We added a reference to this work.